PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-197696

(43)Date of publication of application : 19.07.2001

(51)Int.Cl. H02K 3/28
H02K 21/16

(21)Application number : 2000-005358

(22)Date of filing : 14.01.2000

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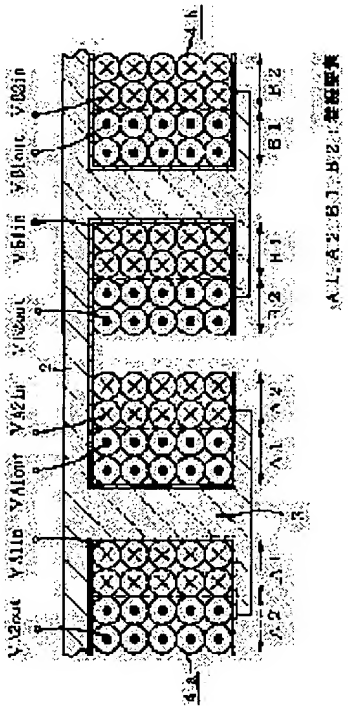
(54) ROTARY ELECTRIC MACHINE AND MANUFACTURING METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To improve a space factor and winding workability and reduce the number of processes and the number of components, using thin wires.

SOLUTION: Adjacent in-phase windings 4a, 4b are constituted of winding elements A1, A2 and B1, B2, respectively. The inside winding element A1 and the outside winding element B2 are connected in series, and A2 and B1 are connected in series. Impedances of both the series circuits are balanced, and connected in parallel. Since the number of parallel circuits is increased, thin wires can be used, workability is improved, and the space factor is improved.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates especially to a stator winding about a dynamo-electric machine and its manufacture methods, such as a motor.
[0002]
[Description of the Prior Art] As coil structure of the conventional dynamo-electric machine where the coil is intensively given to each teeth, there is a synchronous motor shown in JP,09-285088,A. Drawing 20 is a cross section for explaining such a conventional dynamo-electric machine. In drawing, the dynamo-electric machine consists of a stator 20 and a rotator 30. A stator 20 consists of a stator core 22 and a stator winding 24. A stator core 22 is the configuration that consist of circular ring-like stator yoke 22A and stator magnetic pole 22B, and a stator winding 24 is intensively wound around stator magnetic pole 22B. Each stator winding 24 is the configuration of not sharing the magnetic path in an opening side. Thus, since the length of the end coil section can be shortened by considering as the stator structure which winds a stator winding 24 intensively, the physique of a dynamo-electric machine can be made small. U1+, U1-, U2+, and U2- are connected to U phase of a stator winding 24, respectively, V1+, V1-, V2+, and V2- are connected to V phase, respectively, and W1+, W1-, W2+, and W2- are connected to W phase, respectively. Shifting magnetic field are generated by connecting AC power supply to this stator winding 24, and running torque can be obtained by the interaction with a rotator 30.
[0003]
[Problem(s) to be Solved by the Invention] In a dynamo-electric machine like the above-mentioned configuration, it may be necessary to lower the coil impedance seen from the power supply from on constraint of a power supply. In such a case, it is common to lower resistance or an inductance by reducing the number of winding, while making the wire size of a coil thick. A torque characteristic will be maintained, if a current value is increased according to the decrement of the number of turns and the number of ampere-turn is kept the same at this time. However, if the magnet wire of a thick wire size is used in this kind with which one coil is intensively given to each teeth of dynamo-electric machine, since the rigidity of a magnet wire is high, and the workspace in which it twists on the occasion of coil processing, and produces various un-arranging in respect of crookedness, a skid, etc., and a coil is stored is narrow, winding around high density will become difficult.
[0004] in order to solve such a trouble, it was shown in JP,11-206054,A at drawing 21 -- as -- the magnet wire 11 of a thin wire size -- as two or more and a stranded wire -- using -- the conductor of the wire of a thick wire size -- the technology which increases flexibility and winds up easily with a winding machine even in narrow workspace is shown by doubling on a par with the cross section, raising a space factor. However, in the case of the stranded wire using an extra fine wire which is used for the RF use, for example, there is fear of an open circuit of each strand, and also cost starts processing of a stranded wire and it leads to a cost rise of the whole rotating machine. In order to prevent this, when the wire size of each strand was made thick, there was a trouble that it became difficult to raise a space factor and processability. This invention is made in order to solve the above problems, it aims at realizing

improvement in a high space factor and coil processability using the thin charge of a wire rod, and aims at offering the manufacture method which reduced a routing counter and components mark and was suitable for mass production further.
[0005]
[Means for Solving the Problem] It has a stator winding which connects to a serial coil [which prepares two or more k coil elements in each teeth in a dynamo-electric machine which wound a stator winding intensively to each of two or more teeth by which a dynamo-electric machine concerning claim 1 was formed in a stator, and adjoins each other] element of each other formed in q teeth, forms a series circuit, and comes to connect k series circuits with juxtaposition mutually. [two or more] A dynamo-electric machine concerning claim 2 is made into k=nq by making n into a positive integer in a thing according to claim 1.
[0006] A dynamo-electric machine concerning claim 3 differs from the winding direction of a coil element of others [direction / of at least one coil element / winding] in a thing according to claim 1 or 2 among coil elements prepared in one teeth. A dynamo-electric machine concerning claim 4 makes the same the winding direction of all coil elements established in one teeth in a thing according to claim 1 or 2. A dynamo-electric machine concerning claim 5 arranges an insulating member to between [which was prepared in either of claim 1 to claims 4 in a thing of a publication at one teeth / at least / a part of] coil elements.
[0007] Coil element of each other with which a dynamo-electric machine concerning claim 6 was formed in one teeth in a thing given in either of claim 1 to claims 5 is arranged in piles in the direction of a path. A dynamo-electric machine concerning claim 7 makes equal potential of the periphery side edge section of an inside coil element, and potential of the inner circumference side edge section of an outside coil element in a thing according to claim 6 between coil elements which are prepared in one teeth and adjoin mutually. Coil element of each other with which a dynamo-electric machine concerning claim 8 was formed in one teeth in a thing given in either of claim 1 to claims 5 is put in order and arranged to the shaft orientations. A dynamo-electric machine concerning claim 9 makes connection between coil elements to either of claim 1 to claims 8 in a thing of a publication using the same charge of a wire rod as a coil element.
[0008] In a dynamo-electric machine which wound a stator winding intensively to each of two or more teeth prepared in a stator, two or more coil elements are arranged in the shaft orientations, and a dynamo-electric machine concerning claim 10 prepares each other in each teeth, and is equipped with a stator winding which comes to connect coil element of each other with juxtaposition.
[0009] In a manufacture method of a dynamo-electric machine which winds a stator winding intensively to each of two or more teeth by which a manufacture method of a dynamo-electric machine concerning claim 11 was formed in a stator One coil element at a time one by one to each teeth first Winding, after continuing, winding another coil element one by one and forming two or more coil elements on a coil element at each teeth, While connecting to a serial coil element of each other prepared in two or more adjacent teeth and forming a series circuit, two or more series circuits are mutually connected to juxtaposition, and a stator winding is constituted.
[0010] In a manufacture method of a dynamo-electric machine which winds a stator winding intensively to each of two or more teeth by which a manufacture method of a dynamo-electric machine concerning claim 12 was formed in a stator After winding one coil element around teeth first, the charge of a wire rod is tucked up for a terminal as it is. Then, coil element in the winding direction of reverse with this another coil element is wound on the above-mentioned coil element, it moves to teeth which form two or more coil elements, and adjoin teeth continuously, two or more coil elements in the same procedure as the above are formed, and a stator winding is constituted.
[0011]
[Embodiment of the Invention] gestalt 1. of operation -- the gestalt of this operation is an example without q= 2 adjacent inphase coils, middle potential coincidence, and a middle insulating member, as explained below. Drawing 1 is a cross section for explaining the structure of the dynamo-electric machine in the gestalt 1 of implementation of this invention, and 12 teeth by which a cylinder-like stator

and 2 were prepared in the stator core, and 3 was prepared for 1 in the stator core 2, and 4a-4L are the stator windings intensively wound around each teeth 3. The insulating member 8 is arranged between teeth 3 and stator windings 4a-4L. The stator 1 consists of a stator core 2, stator windings 4a-4L, and an insulating member 8. 7 is the rotator prepared in a part for the centrum of a stator 1, 14 permanent magnets 6 counter the surface with a stator 1, it is put on it, and the polarity of the adjacent permanent magnet 6 is arranged so that it may become reverse mutually.

[0012] First, it explains per outlines, such as connection of a stator winding (a "coil" is called hereafter). Coils 4a-4L are connected to the three-phase-alternating-current power supply which is not summarized and illustrated by three groups. With the gestalt of this operation, four, W phase winding, and 4e, 4f, 4k and 4L, become [four, 4a, 4b 4g and 4h / four, U phase winding, and 4c, 4d, 4i and 4j,] V phase winding among 12 coils 4a-4L. That is, it is the example which set the adjacent number q of inphase coils to 2. That is, the coil of two adjacent teeth 3 is the coil of an inphase. In U phase winding, Coils 4a and 4h see from the medial axis of a dynamo-electric machine and have the the same direction where current flows, and, as for these two and Coils 4b and 4g, the direction of current where it flows becomes reverse. The same is said of V phase and W phase winding.

[0013] Here, the phase relation of each phase winding is explained in consideration of symmetric property using 4a-4f of one half among 12 coils 4a-4L. Each coils 4a-4L have the phase contrast of 7pi/6 by the electrical angle, respectively from the relation between the number of the above-mentioned teeth 3, and the number of a permanent magnet 6. In U phase winding, the polarity of coil 4a and the next coil 4b which has the phase contrast of 7pi/6 by the electrical angle is reversed. Therefore, the induced voltage generated in each coil will have pi/6 of phase contrast. And coil 4a and coil 4b are mutually connected to a serial. Moreover, the series circuit of Coils 4a and 4b and a Coils [4g and 4h] series circuit are mutually connected to juxtaposition. About the details of connection, it mentions later.

[0014] Drawing 2 is the vector diagram having shown the relation between the induced voltage of each coil, and the synthetic induced voltage of each phase winding. U1, U2, W1, W2, V1, and V2 are Coils [4a-4f] voltage, respectively. Since Coils 4b, 4c, and 4f make polarity reverse and series connection is carried out to the inphase coils 4a, 4d, and 4e which adjoin each other, respectively, polarity is reversed and U2, W1, and V2 are compounded with U1, W2, and V1, respectively. Star connection of the coils 4a-4L is carried out, and they came to have shown the phase voltage of each phase by U, V, and W, and have the phase contrast of 2pi/3 mutually. In addition, what the coil of 1 to 6 teeth reversed, respectively is repeated after remaining parts for a semicircle, i.e., 7 teeth eye, of a stator 1.

[0015] 2cos(pi/12) =1.93185 of the voltage v generated in each coils 4a-4L as two voltage composition of vectors which has pi/6 of phase contrast in each phase after all -- Twice as many voltage as this occurs. The synthetic induced voltage generated in U phase winding when there is no phase contrast in coil 4a and coil 4b should be set to 2v, and is these ratios, 1.93185 [i.e.,]. -- /2=0.9659 -- is called a distribution factor. Thus, if the stator winding by which connection was carried out is connected to a three-phase-alternating-current power supply and alternating current is energized, the magnetic field by current will occur in each teeth, and torque will occur by the interaction of this and a permanent magnet 6.

[0016] Next, more concrete coil structure is explained using drawing 3 thru/or drawing 6 . Drawing 3 is the cross section having taken out and shown the portion equivalent to the adjacent inphase coils 4a and 4b. x mark and the sunspot mark are marks which show not the direction of current but the winding direction among drawing. Coil 4a consists of a coil element A1 arranged inside and a coil element A2 arranged outside, and the coil elements A1 and A2 are rolled in the shape of the said heart to teeth 3. Similarly, coil 4b consists of a coil element B1 arranged inside and coil element B-2 arranged outside. In four coil elements A1, A2, and B1 and B-2, a cut water, i.e., the inside coil edge of the side near teeth 3, is set to VA1inch, VA2inch, VB1inch, and VB2inch, respectively, and rolling it is finished, namely, the outside coil edge of a side far from teeth 3 is set to VA1out, VA2out, VB1out, and VB2out, respectively.

[0017] Drawing 4 is the schematics showing the connection condition of a coil. Since resistance may differ since coil length differs, and also distance with an iron core (teeth 3) differs, the coil elements A1

and B1 arranged inside among four coil elements A1, A2, and B1 and B-2 and the coil element A2 arranged outside may differ also in an inductance from B-2. However, as shown in drawing 4 , by connecting the coil element A1, B-2, and the coil elements A2 and B1 to a serial, respectively, the imbalance of the impedance between both series circuits can be prevented, and generating of the circulating current when carrying out parallel connection of both the series circuits mutually can be controlled. Moreover, outside coil edge VA1out of the middle potential A1, i.e., a coil element, and inside coil edge VA2inch of the coil element A2 are these potentials mostly, and since the potential difference hardly arises between the periphery sides of the coil element A2 the inner circumference side of the coil element A1, it is not necessary to prepare an insulating member special in the meantime, so that drawing 4 may show. The same is said of the coil element B1 and B-2.

[0018] Next, the coil method is explained using drawing 3 and drawing 5 . Drawing 5 is explanatory drawing of the coil method, leaves a terminal 41 first and rolls the coil element A1 inside coil 4a in order of VA1inch-> VA1out. After finishing winding A1, a coil is tucked up for a terminal 43 and the coil element A2 is continuously wound around it in order of VA2inch-> VA2out as it is. The coil elements A1 and A2 make the winding direction reverse. After finishing winding A2, a coil is tucked up for a terminal 42 and a coil is tucked up for the terminal 45 which is in the next teeth 3 continuously as it is. Hereafter, similarly, after winding in order of the terminal 45 -> coil element B1 -> terminal 46 -> coil element B-2-> terminal 44, it tucks up for the first terminal 41 and a coil activity is ended. Then, it fixes in each terminals 41-46, making it flow through a coil and a terminal using means, such as fusing (heat caulking).

[0019] A three phase coil as shown in drawing 6 can consist of giving connection the same with having stated above also in the inphase coil with which each other is adjoined other than 4a and 4b, and carrying out parallel connection of these for every phase, and considering as star connection.

[0020] By giving connection in the above procedures, coil processing of the connection of an adjacent inphase coil and the meantime can be continuously carried out at the same charge of a wire rod, and a routing counter can be reduced. Moreover, a terminal 43 and a terminal 46 turn into a terminal of these two coils 4a and 4b, and, as for terminals 41, 42, 44, and 45, that middle potential is taken so that drawing 4 and drawing 5 may show. Considering the condition of having connected the equivalence power supply 47 per plane 1, current i2 flows to coil element B-2 and A1, and current i1 flows to the coil elements B1 and A2, respectively. Although this value is decided by each impedance, since the impedance is almost equal respectively, the coil elements B1 and A1, B-2, and A2 can make current i1 and i2 almost equal as mentioned above.

[0021] In addition, in the gestalt of this operation, although the coil of each phase, for example, the example which connects 4a, 4b, and 4g and 4h to juxtaposition, was shown, as balance with a power supply showed to drawing 7 , it is good also as series connection. Moreover, although the example which carries out star connection of the three phase circuit was shown, you may make it triangle connection. In that case, if supply voltage is the same, the number of winding of a coil will increase and current will decrease.

[0022] gestalt 2. of operation -- several [of the inphase coil with which the gestalt of this operation adjoins each other] -- it is an example without q= 2, middle potential coincidence, and a middle insulating member. Drawing 8 is drawing for explaining the coil method in the gestalt 2 of implementation of this invention, and the same portion as drawing 5 omits explanation. With the gestalt of this operation, a terminal 51, 56, 52, 55 and 53, and 54, 57 and 58 are connected using the connection material 59, 60, 61, and 62, respectively. The coil method in this case is explained below.

[0023] A terminal 53 is left first, the coil element A1 inside coil 4a is rolled, and a coil is tucked up for a terminal 52. Then, a terminal 51 is left, the coil element A2 is wound around the coil element A1 and hard flow, and a coil is tucked up for a terminal 54. Similarly, it winds in order of the terminal 57 -> coil element B1 -> terminal 56 and the terminal 55 -> coil element B-2-> terminal 58, and a coil activity is ended. Finally, it fixes in each terminal, making it flow through a coil and a terminal using means, such as fusing. Others are the same as that of the gestalt 1 of operation. Although a coil activity cannot be done continuously but the gestalt of this operation takes cutting for every coil element, since connection

between each coil element is made using the connection material 59-62, the time amount which a coil takes can be shortened.
[0024] In addition, in the gestalt of this operation, although the example which winds the coil element A2 around the degree which wound the coil element A1 was shown, since each coil element can be wound independently, the coil element B1 may be wound after the coil element A1. In this case, in all the coils covering the perimeter, since the coil activity by the side of a periphery can be done on hard flow after doing the coil activity by the side of inner circumference in this direction, the flexibility on production processes, such as making the winding machine by the side of inner circumference and a periphery into another thing, for example, will increase.
[0025] gestalt 3. of operation -- several [of the inphase coil with which the gestalt of this operation adjoins each other] -- it is an example with q= 2, a middle potential inequality, and a middle insulating member. It is drawing for the cross section of the adjacent inphase coil shown in order that drawing 9 might explain the coil method in the gestalt 3 of implementation of this invention, and drawing 10 to explain the schematics of a coil, and for drawing 11 explain that coil method, and the same portion as drawing 3 thru/or drawing 5 omits explanation in these drawings. In the gestalt of this operation, unlike the gestalten 1 and 2 of operation, all coil elements are wound in this direction so that drawing 9 and drawing 11 may show. A terminal 71, 76, 72, 75 and 73, and 74, 77 and 78 are connected using the connection material 79, 80, 81, and 82, respectively. The coil method in this case is explained below.
[0026] A terminal 73 is left first, the coil element A1 inside coil 4a is rolled, and a coil is tucked up for a terminal 72. Then, a terminal 74 is left, the coil element A2 is rolled in the coil element A1 and this direction, and a coil is tucked up for a terminal 71. Similarly, it winds in order of the terminal 77 -> coil element B1 -> terminal 76 and the terminal 78 -> coil element B-2-> terminal 75, and a coil activity is ended. Finally, it fixes in each terminal, making it flow through a coil and a terminal using means, such as fusing.
[0027] In this case, the coil element A1 cannot wind and VA1out which is the potential by the side of the end, and VA2inch which is the potential by the side of the cut water of the coil element A2 cannot be made into this potential. For this reason, the insulating member 9 is formed among the coil elements A1 and A2. An insulating member 9 may wind a tape-like thing from a coil, and may also put tabular resin etc. When the potential difference is small enough, it is also possible to omit an insulating member 9. Others are the same as that of the gestalt 1 of operation.
[0028] In addition, in the gestalt of this operation, although the example which winds the coil element A2 around the degree which wound the coil element A1 was shown, since each coil element can be wound independently, the coil element B1 may be wound after the coil element A1. In this case, in all the coils covering the perimeter, after doing the coil activity by the side of inner circumference in this direction, since the coil activity by the side of a periphery can be done in this direction, the winding machine by the side of inner circumference and a periphery can be made into another thing, and also in case an insulating member 9 is installed, the flexibility on production processes -- the activity to each teeth 3 can be done in succession -- will increase.
[0029] gestalt 4. of operation -- the gestalt of this operation is the example which divided the coil in the direction of a path of a dynamo-electric machine. In order that drawing 12 may explain the coil method in the gestalt 4 of implementation of this invention, it is the cross section having shown coil 4a thru/or near 4b, and the same portion as drawing 9 omits explanation. two coil elements A1 and A2 which constitute coil 4a as the coil method in the gestalt of this operation -- the direction of a path of a dynamo-electric machine -- two -- arranging -- an insulating member 10 -- with -- **** -- division arrangement is carried out. That is, division arrangement is carried out at the opening side of a slot the pars-basilaris-ossis-occipitalis side of the slot which is the coil configuration space between teeth. Others are the same as that of the gestalt 3 of operation.
[0030] When it considers as such arrangement, a difference ceases to be seen and the flexibility of most of the impedance of the coil elements A1 and A2 of connection increases. That is, after connecting B-2, and A2 and B1 to a serial, respectively, it is desirable to connect these to juxtaposition mutually, but if a coil element is arranged like the gestalt of this operation, since there will almost be no impedance

difference, after connecting the coil element A1, B1 and A2, and B-2 to a serial, respectively, it also becomes possible to connect these to juxtaposition mutually. [the coil element A1, and]
[0031] gestalt 5. of operation -- several [of the inphase coil with which the gestalt of this operation adjoins each other] -- it is the example of q= 3. A cross section for drawing 13 to explain the structure of the dynamo-electric machine in the gestalt 5 of implementation of this invention, the cross section of the inphase coil with which drawing 14 adjoins each other, and drawing 15 are those schematics, and the same portion as drawing 1 , drawing 9 , and drawing 10 omits explanation in these drawings. As the gestalt of this operation is shown in drawing 13 , the number of the permanent magnets 6 which are a pole is shown about the example which set the number of 16 and teeth 3 to 18. In this case, it is common to set several q of an adjacent inphase coil to 3. For example, among 18 coils, 4d, 4e, 4f, 4m, 4n, and 4o are connected to W phase, and 4g, 4h, 4i, 4p, 4q, and 4r are connected to U phase for 4a, 4b, 4c, 4j, 4k, and 4L at V phase.
[0032] Drawing 14 expands and shows three coils 4a, 4b, and 4c of U phase among these. Coils 4a, 4b, and 4c consist of the coil element A1 - A3, B1-B3, and C1-C3, respectively. Drawing 15 explains these connection and connects to juxtaposition three of thing **s which connected to the serial A1, B-2, the thing that connected three of C3 to the serial, the thing which connected three, A2, B3, and C1, to the serial, A3, and three, B1 and C2. Others are the same as that of the gestalt 3 of operation. Thus, the number of parallel circuits can be increased with constituting, controlling the circulating current by the imbalance of the impedance of each coil element. That is, the coil impedance seen from the power supply can be made small like the gestalten 1-4 of operation, winding a coil using a thin lead wire of a wire size.
[0033] In addition, in the gestalt of this operation, the example which winds each coil element in this direction in each teeth 3 is shown. In this case, like the gestalt 3 of operation, between the coil elements with which middle potential is not in agreement and adjoins each other, since the potential difference occurs, the insulating member 9 has been formed. Of course, it is also possible to devise the winding direction so that the potential difference may not arise, and to omit all or a part of insulating member 9. Moreover, although the case where the coil element in each teeth 3 was divided into the middle three a periphery side far from teeth 3 the inner circumference side near teeth 3 was shown in the above-mentioned explanation a coil element [in / like the gestalt 4 of operation / as shown in drawing 16 instead of what is restricted to this / each teeth 3] -- the direction of a path of a dynamo-electric machine -- three -- arranging -- an insulating member 10 -- with -- **** -- this may be connected after carrying out division arrangement.
[0034] gestalt 6. of operation -- the gestalt of this operation is the example of q= 1, when there is no inphase coil which otherwise adjoins each other that is,. It is a cross section for drawing 17 to explain the structure of the dynamo-electric machine in the gestalt 6 of implementation of this invention, and the cross section in which drawing 18 expanded coil 4a, and it was shown, and the same portion as drawing 1 and drawing 3 omits explanation in these drawings. In the gestalt of this operation, as shown in drawing 17 , the number of the permanent magnets 6 which are a pole is shown about the example which set the number of 4 and teeth 3 to 6. In this case, it is common to set several q of an adjacent inphase coil to 1. Others are the same as that of the gestalt 1 of operation.
[0035] In this case, the method shown with the gestalt 1 of operation of canceling the imbalance of an impedance by connecting with a serial beforehand between adjacent teeth cannot be taken. Therefore, it arranged in the direction of a path of a dynamo-electric machine at the division arrangement, i.e., slot pars basilaris ossis occipitalis, and slot opening side, and two coil elements A1 and A2 are arranged so that the impedance of two coils wound around the same teeth may be made as equal as possible. 10 is an insulating member arranged between coil elements. Thus, a coil element is arranged, a parallel connection is carried out mutually, by connecting to a three phase, it came to be shown in drawing 19 and the number of parallel circuits can be increased rather than the number of teeth.
[0036] In the above, the gestalten 1-6 of operation of this invention were explained. Although the gestalt of the above-mentioned implementation explained the case where several q of an adjacent inphase coil was set to 1 thru/or 3, it may not be restricted to this and q may be how many. several k [moreover,] of

the coil element wound around one teeth -- the case of q= 1 -- k= 2 -- carrying out -- q= -- although the case where it considered as k=q about 2 and 3 was explained, it is not restricted to this and the same effect as the gestalt of the above-mentioned implementation can be acquired from making k into q, the same number, or the integral multiple of q. Furthermore, the same effect is acquired also by arranging the coil element of each other in piles, and connecting in series connection with the coil element of adjacent teeth combining the coil element of an outside, the inside, and centers by q= 2 and k= 3, for example. Moreover, although the case where a three phase coil was constituted from a gestalt of the above-mentioned implementation was explained, it does not restrict to this and the same is said of the polyphase coil of arbitration other than a three phase. Furthermore, although the example which used the permanent magnet for the rotator side was shown, the configuration of a rotator is not restricted to it. Moreover, it cannot be overemphasized that the same effect is acquired also not only in motor actuation but in the thing which operates as a generator.

[0037]

[Effect of the Invention] since the dynamo-electric machine concerning claim 1 carried out series connection of the q adjacent coil elements of teeth mutually and parallel connection of the series circuit was carried out mutually -- juxtaposition of a stator winding -- a conductor -- being able to increase a number and using a flexible conductor thinly therefore -- processability -- improving -- moreover -- therefore, a space factor improves. Since the dynamo-electric machine concerning claim 2 was made into k=nq, it can obtain the balance of an impedance easily by symmetry arrangement.

[0038] Since the winding direction of at least one coil element differs from others, the dynamo-electric machine concerning claim 3 can control the potential difference of the portion which adjoins between coil elements. Since the dynamo-electric machine concerning claim 4 was made the same as the winding direction of all coil elements, it becomes easy to automate [of a coil] it. Since the dynamo-electric machine concerning claim 5 has arranged the insulating member between coil elements, it can prevent dielectric breakdown.

[0039] Since the dynamo-electric machine concerning claim 6 has arranged the coil element in piles in the direction of a path, it becomes easy to automate [of a coil] it. Since the dynamo-electric machine concerning claim 7 made equal potential of the periphery side edge section of an inside coil element, and the inner circumference side edge section of an outside coil element, automation of a coil is easy for it, and the insulating member for preventing dielectric breakdown between both coil elements does not need to be used for it.

[0040] Since the dynamo-electric machine concerning claim 8 has arranged the coil element side by side to the shaft orientations, it can make the impedance of a coil element equal mutually. Since the dynamo-electric machine concerning claim 9 makes connection between coil elements at the same charge of a wire rod as a coil element, it can reduce components mark.

[0041] Since the dynamo-electric machine concerning claim 10 put in order and prepared the coil element in the shaft orientations and each other carried out parallel connection, it can increase the number of parallel circuits, making an impedance balance also by the case of q= 1.

[0042] Since the manufacture method of the dynamo-electric machine concerning claim 11 winds one coil element at a time one by one and winds another coil on it around each teeth to each teeth continuously, its flexibility on a production process increases by use of a winding machine, installation of an insulating member, etc.

[0043] Since the manufacture method of the dynamo-electric machine concerning claim 12 is tucked up for a terminal as it is, then moves from another coil element on the above-mentioned coil element at winding and the teeth which adjoin each other continuously and winds a coil element in a procedure similarly after it winds one coil element Coil processing of the connection of an adjacent inphase coil and the meantime can be continuously carried out at the same charge of a wire rod, therefore reduction of a routing counter and reduction of components mark can be performed.

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CLAIMS

[Claim(s)]
[Claim 1] A dynamo-electric machine characterized by to have a stator winding which connects to a serial the above-mentioned [which prepares two or more k coil elements in above-mentioned each teeth in a dynamo-electric machine which wound a stator winding intensively to each of two or more teeth prepared in a stator, and adjoins each other] coil element of each other prepared in the q above-mentioned teeth, forms a series circuit, and comes to connect the k above-mentioned series circuit with juxtaposition mutually. [two or more]
[Claim 2] A dynamo-electric machine according to claim 1 characterized by considering as k=nq by making n into a positive integer.
[Claim 3] A dynamo-electric machine according to claim 1 or 2 characterized by the winding direction of at least one above-mentioned coil element differing from the winding direction of other above-mentioned coil elements among coil elements prepared in one teeth.
[Claim 4] A dynamo-electric machine according to claim 1 or 2 characterized by the winding direction of all coil elements established in one teeth being the same.
[Claim 5] A dynamo-electric machine given in either of claim 1 to claims 4 characterized by having arranged an insulating member to between [which was prepared in one teeth / at least / a part of] coil elements.
[Claim 6] A coil element prepared in one teeth is a dynamo-electric machine given in either of claim 1 to claims 5 characterized by having arranged in piles in the direction of a path mutually.
[Claim 7] A dynamo-electric machine according to claim 6 characterized by making equal potential of the periphery side edge section of an inside coil element, and potential of the inner circumference side edge section of an outside coil element between coil elements which are prepared in one teeth and adjoin mutually.
[Claim 8] A coil element prepared in one teeth is a dynamo-electric machine given in either of claim 1 to claims 5 characterized by having arranged and arranged to the shaft orientations mutually.
[Claim 9] A dynamo-electric machine given in either of claim 1 to claims 8 characterized by making connection between coil elements using the same charge of a wire rod as the above-mentioned coil element.
[Claim 10] A dynamo-electric machine characterized by having a stator winding which arranges two or more coil elements in the shaft orientations, prepares each other in each above-mentioned teeth in a dynamo-electric machine which wound a stator winding intensively to each of two or more teeth prepared in a stator, and comes to connect the above-mentioned coil element of each other with juxtaposition.
[Claim 11] In a manufacture method of a dynamo-electric machine which winds a stator winding intensively to each of two or more teeth prepared in a stator One coil element at a time one by one to each above-mentioned teeth first Winding, after continuing, winding another coil element one by one and forming two or more coil elements on the above-mentioned coil element at each above-mentioned teeth, A manufacture method of a dynamo-electric machine characterized by connecting mutually two or

more above-mentioned series circuits to juxtaposition, and constituting a stator winding while connecting to a serial the above-mentioned coil element of each other prepared in two or more adjacent above-mentioned teeth and forming a series circuit.
[Claim 12] In a manufacture method of a dynamo-electric machine which winds a stator winding intensively to each of two or more teeth prepared in a stator After winding one coil element around the above-mentioned teeth first, the charge of a wire rod is tucked up for a terminal as it is. Then, a manufacture method of a dynamo-electric machine characterized by winding a coil element other than the above-mentioned coil element in the winding direction of reverse, moving to teeth which form two or more coil elements, and adjoin the above-mentioned teeth continuously, forming two or more coil elements in the same procedure as the above on the above-mentioned coil element, and constituting a stator winding.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
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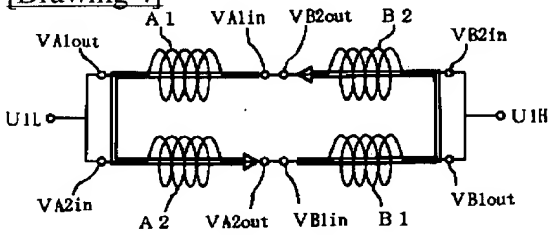
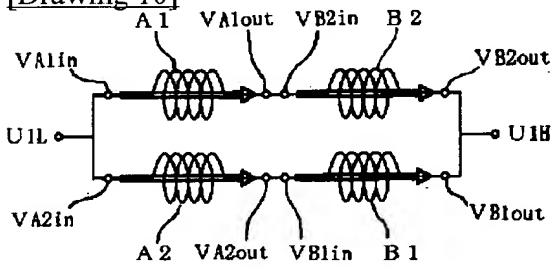
DRAWINGS

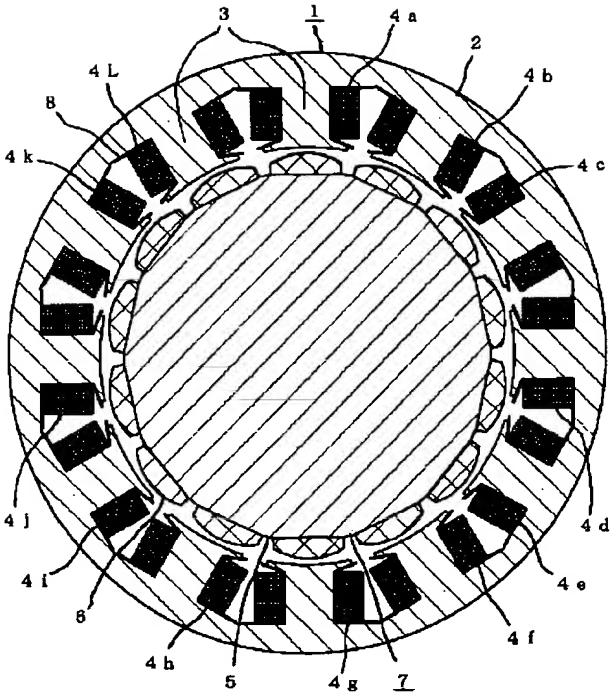
[Drawing 4]



[Drawing 10]

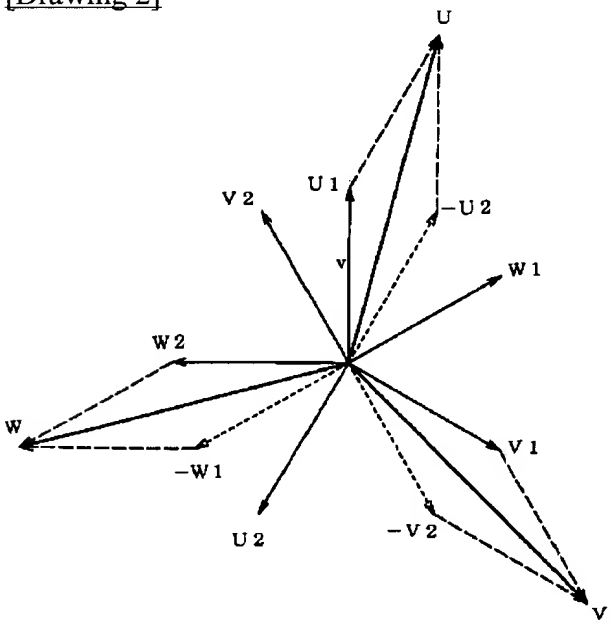


[Drawing 1]

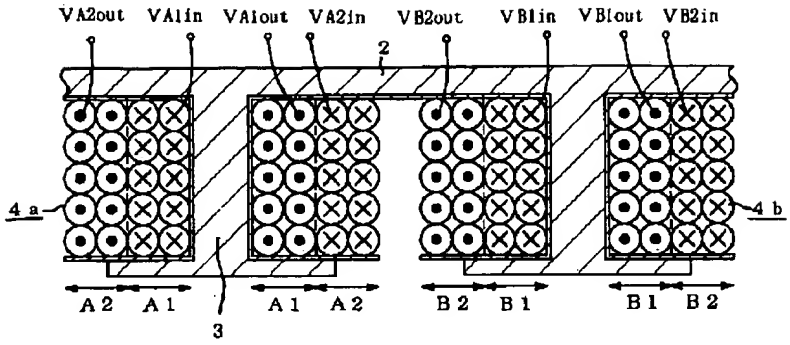


1：固定子
3：ティース
4 a～4 L：固定子巻線

[Drawing 2]

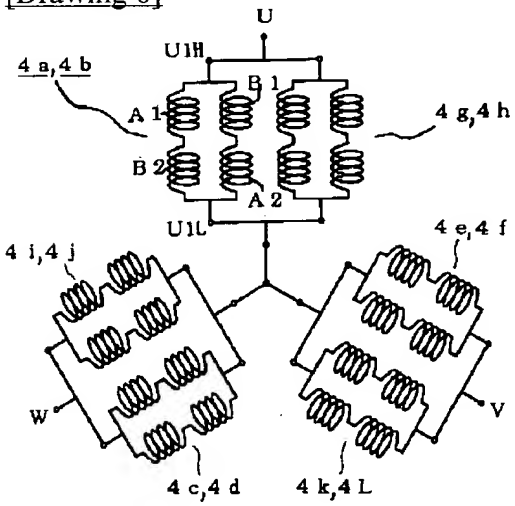


[Drawing 3]

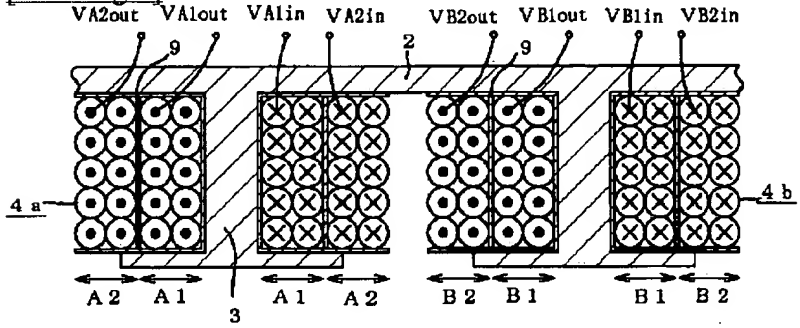


A 1, A 2, B 1, B 2 : 巻線要素

[Drawing 6]

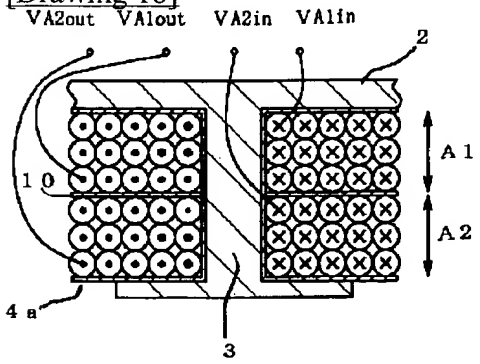


[Drawing 9]

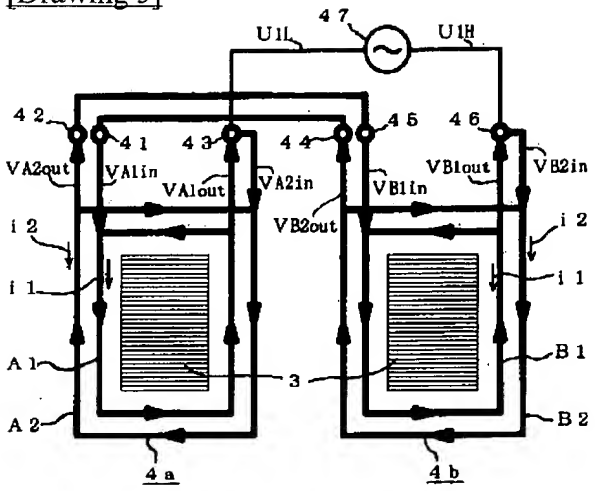


9 : 絶縁部材

[Drawing 18]

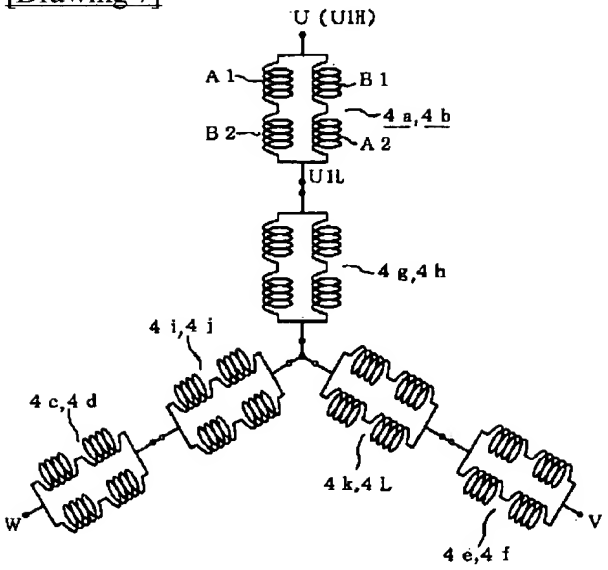


[Drawing 5]

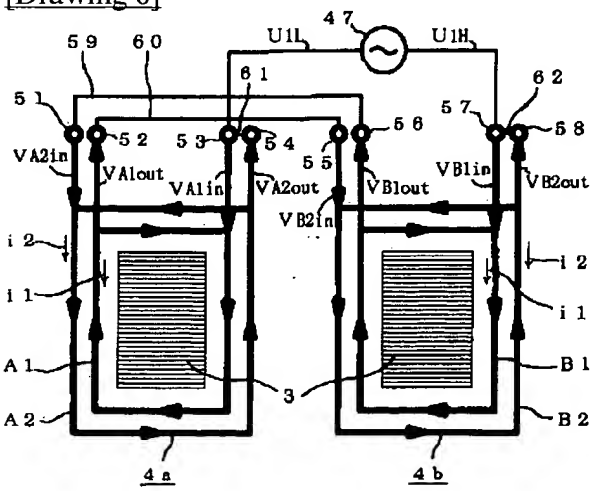


41～46：端子

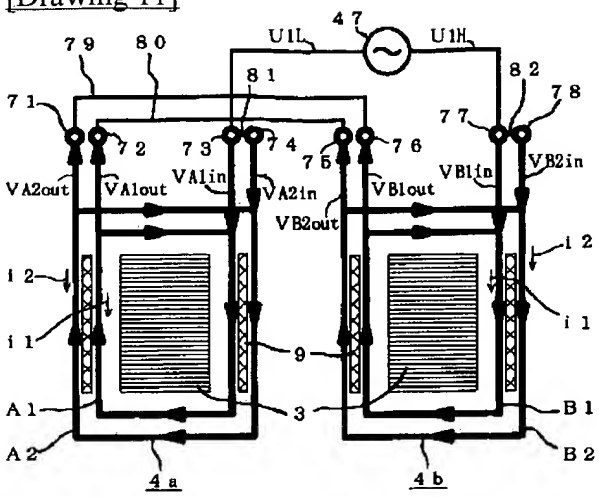
[Drawing 7]



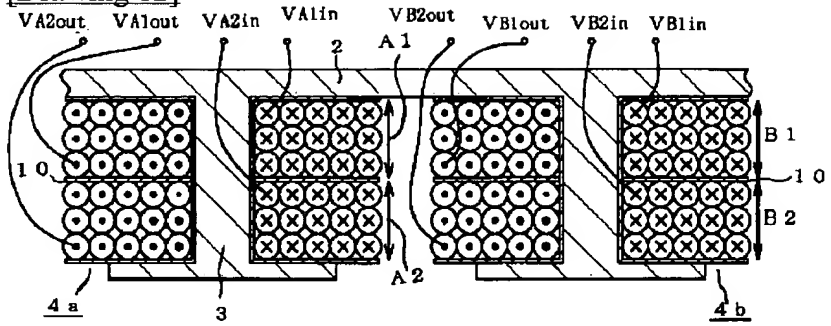
[Drawing 8]



[Drawing 11]

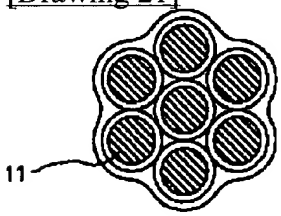


[Drawing 12]

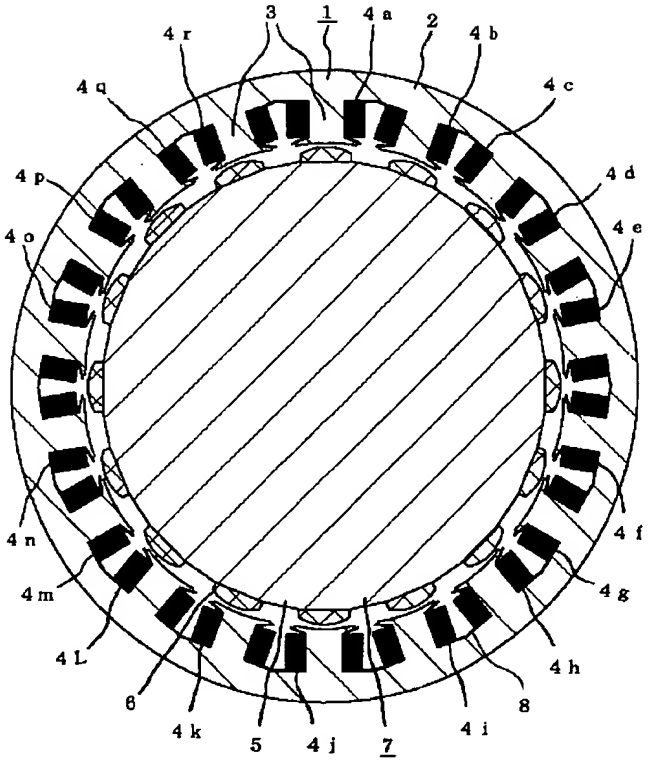


10：絶縁部材

[Drawing 21]

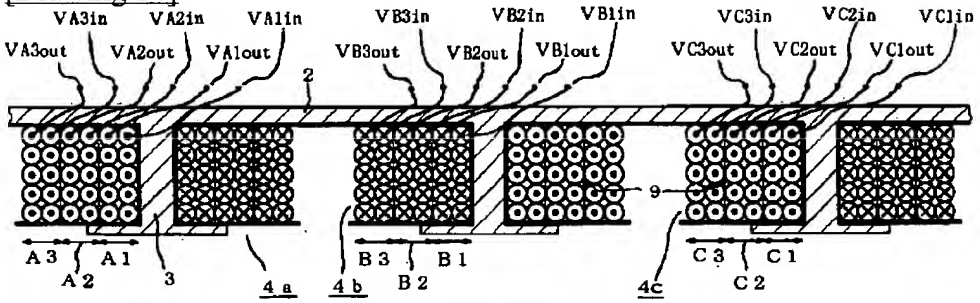


[Drawing 13]



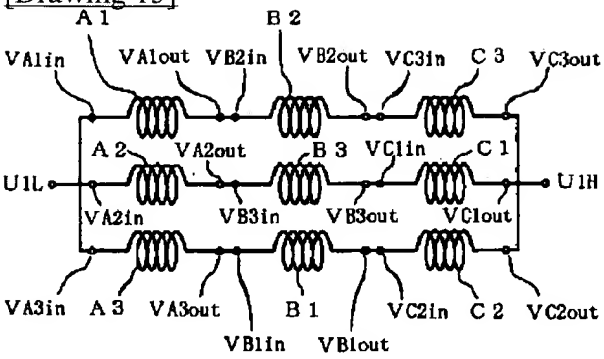
4m～4r：固定子巻線

[Drawing 14]

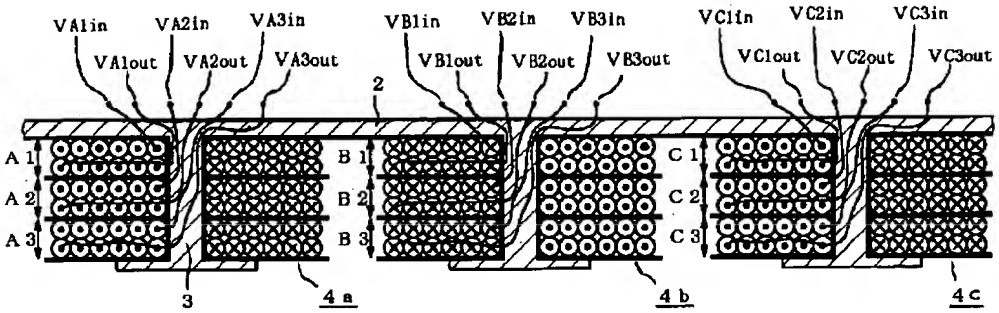


A3，B3，C1～C3：巻線要素

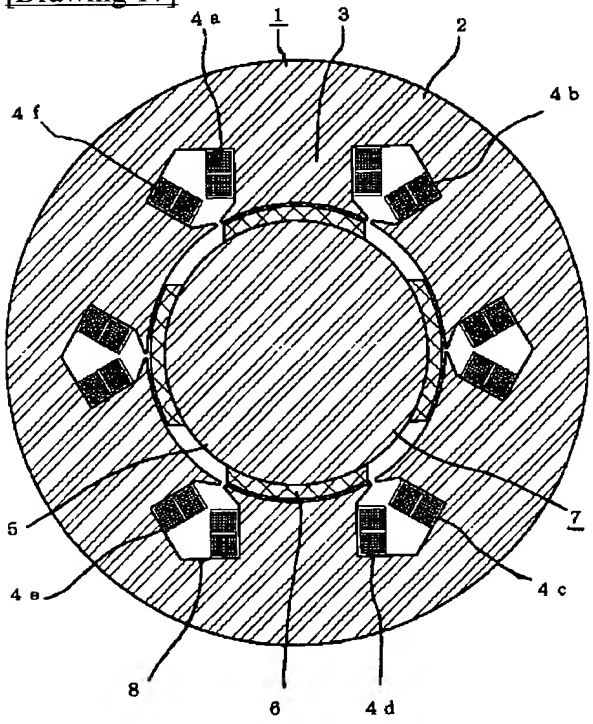
[Drawing 15]



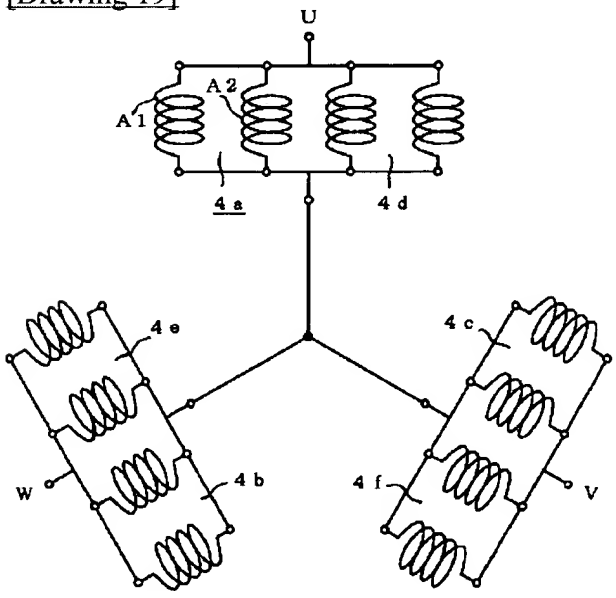
[Drawing 16]



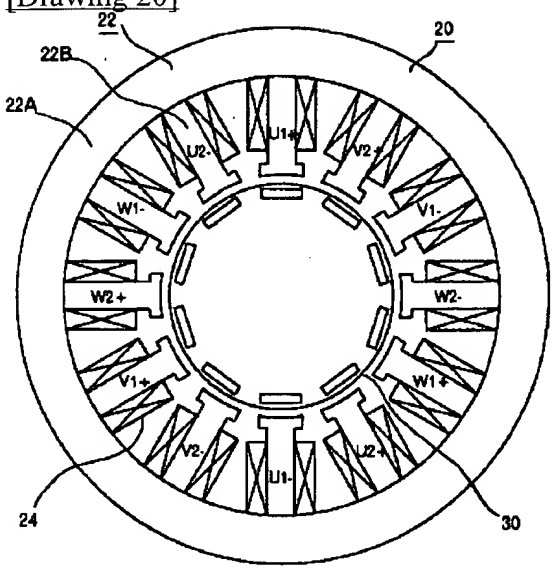
[Drawing 17]



[Drawing 19]



[Drawing 20]



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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section of the dynamo-electric machine in the gestalt 1 of implementation of this invention.
[Drawing 2] It is a vector diagram explaining the relation of the voltage in the gestalt 1 of implementation of this invention.
[Drawing 3] It is the cross section of the coil portion in the gestalt 1 of implementation of this invention.

[Drawing 4] They are the schematics of the coil in the gestalt 1 of implementation of this invention.
[Drawing 5] It is explanatory drawing of the coil method in the gestalt 1 of implementation of this invention.
[Drawing 6] implementation of this invention be alike gestalt 1 -- they are the schematics of a bucket whole set line.
[Drawing 7] They are the schematics of other examples of the whole set line in the gestalt 1 of implementation of this invention.
[Drawing 8] It is explanatory drawing of the coil method in the gestalt 2 of implementation of this invention.
[Drawing 9] It is the cross section of the coil portion in the gestalt 3 of implementation of this invention.

[Drawing 10] They are the schematics of the coil in the gestalt 3 of implementation of this invention.
[Drawing 11] It is explanatory drawing of the coil method in the gestalt 3 of implementation of this invention.
[Drawing 12] It is the cross section of the coil portion by the gestalt 4 of implementation of this invention.
[Drawing 13] It is the cross section of the dynamo-electric machine in the gestalt 5 of implementation of this invention.
[Drawing 14] It is the cross section of the coil portion in the gestalt 5 of implementation of this invention.
[Drawing 15] They are the schematics of the coil in the gestalt 5 of implementation of this invention.
[Drawing 16] It is the cross section of other examples of the coil portion in the gestalt 5 of implementation of this invention.
[Drawing 17] It is the cross section of the dynamo-electric machine in the gestalt 6 of implementation of this invention.
[Drawing 18] It is the cross section of the coil portion in the gestalt 6 of implementation of this invention.
[Drawing 19] They are the schematics of the whole set line in the gestalt 6 of implementation of this invention.
[Drawing 20] It is the cross section of the conventional dynamo-electric machine.
[Drawing 21] It is the cross section of the stranded wire of the conventional dynamo-electric machine.

[Description of Notations]
1 A stator, 3 Teeth, 4a-4r A stator winding, 8, 9, 10 An insulating member, 41-46, 51-58, 71-78 A terminal, 59-62, 79-82 Connection material, A1 - A3, B1-B3, C1-C3 Coil element.

[Translation done.]